

THE CLAIMS

What Is Claimed Is:

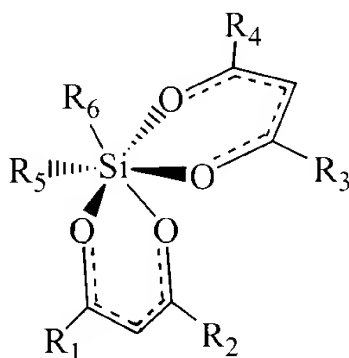
1. A hexacoordinated silicon beta-diketonate composition of the formula $R_2Si(\beta\text{-diketonate})_2$ or $(RO)_2Si(\beta\text{-diketonate})_2$, wherein each R is the same as or different from the other R, and
5 each R is independently selected from H, aryl, fluoroaryl, $C_1 - C_{12}$ alkyl, $C_1 - C_{12}$ fluoroalkyl, and $C_1 - C_{12}$ silicon-containing alkyl.
2. The composition of claim 1, wherein each β -diketonate ligand of the composition may be the same as or different from the other β -diketonate ligand of the composition, and is
10 independently selected from: 2,2,6,6-tetramethyl-3,5-heptanedionate; 1,1,1,2,2,3,3-heptafluoro-7,7-dimethyloctane-4,6-dionate; acetylacetonate; trifluoroacetylacetonate; and hexafluoroacetylacetonate.
3. The composition of claim 1, wherein each β -diketonate ligand of the composition is
15 2,2,6,6-tetramethyl-3,5-heptanedionate.
4. The composition of claim 1, of the formula $R_2Si(\beta\text{-diketonate})_2$.
5. The composition of claim 1, of the formula $(RO)_2Si(\beta\text{-diketonate})_2$.
- 20 6. $(t\text{-BuO})_2Si(\text{thd})_2$.
7. $(CH_3)_2Si(\text{thd})_2$.

8. A precursor formulation, comprising a solvent solution including a hexacoordinated silicon beta-diketonate composition as in claim 1.

5 9. The formulation of claim 8, wherein the liquid solvent solution includes a hydrocarbon solvent.

10. The formulation of claim 8, wherein the liquid solvent solution includes octane.

10 11. A silicon β -diketonate of the formula:



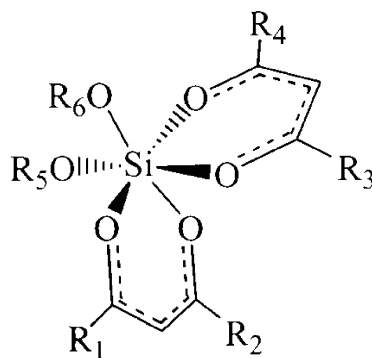
15 wherein:

R_1 , R_2 , R_3 and R_4 are the same as or different from one another, and wherein each of such substituents is independently selected from H, aryl, fluoroaryl, $C_1 - C_{12}$ alkyl, $C_1 - C_{12}$ fluoroalkyl, and $C_1 - C_{12}$ silicon-containing alkyl; and

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R₅ and R₆ are same as or different from one another, and each is independently selected from H, aryl, fluoroaryl, C₁ - C₁₂ alkyl, C₁ - C₁₂ fluoroalkyl, and C₁ - C₁₂ silicon-containing alkyl.

- 5 12. A silicon β-diketonate of the formula:



wherein:

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R₁, R₂, R₃ and R₄ are the same as or different from one another, and wherein each of such substituents is independently selected from H, aryl, fluoroaryl, C₁ - C₁₂ alkyl, C₁ - C₁₂ fluoroalkyl and C₁ - C₁₂ silicon-containing alkyl; and

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R₅ and R₆ are same as or different from one another, and each is independently selected from H, aryl, fluoroaryl, C₁ - C₁₂ alkyl, C₁ - C₁₂ fluoroalkyl, and C₁ - C₁₂ silicon-containing alkyl.

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13. A. chemical vapor deposition precursor comprising an alkoxide β-diketonate silicon precursor in combination with at least one of (a) and (b):

(c) an alkoxide β -diketonate precursor for one or more of Zr, Hf, Nb, and Ta; and

(d) a β -diketonate precursor for one or more of Y, La, Sr and Ba.

- 5 14. A method of depositing a silicon-containing film on a substrate by chemical vapor deposition using a precursor including a hexacoordinated silicon beta-diketonate composition as in claim 1.
15. The method of claim 14, wherein the chemical vapor deposition is carried out at
10 temperature below about 600°C.
16. The method of claim 14, wherein each β -diketonate ligand of the composition may be the same as or different from the other β -diketonate ligand of the composition, and is independently selected from: 2,2,6,6-tetramethyl-3,5-heptanedionate; 1,1,1,2,2,3,3-hepta-
15 fluoro-7,7-dimethyloctane-4,6-dionate; acetylacetonate; trifluoroacetylacetonate; and hexafluoroacetylacetonate.
17. The method of claim 14, wherein each β -diketonate ligand of the composition is 2,2,6,6-tetramethyl-3,5-heptanedionate.
- 20 18. The method of claim 14, wherein the composition is of the formula $R_2Si(\beta\text{-diketonate})_2$.
19. The method of claim 14, wherein the composition is of the formula $(RO)_2Si(\beta\text{-diketonate})_2$.
- 25 20. The method of claim 14, wherein the precursor includes $(t\text{-BuO})_2Si(\text{thd})_2$.

21. The method of claim 14, wherein the precursor includes $(\text{CH}_3)_2\text{Si}(\text{thd})_2$.
22. The method of claim 14, wherein the precursor includes a hydrocarbon solvent.
- 5 23. The method of claim 14, wherein the precursor includes octane.
24. The method of claim 14, wherein the silicon-containing film constitutes at least part of a gate dielectric of a microelectronic device structure.
- 10 25. The method of claim 14, wherein the silicon-containing film constitutes a dielectric material on the substrate.
26. The method of claim 14, wherein the silicon-containing film comprises a silicon oxy-
15 nitride film.
27. The method of claim 14, further comprising conducting the chemical vapor deposition with a co-precursor comprising a metal (β -diketonate) complex for doping the silicon-containing film with the metal of said metal (β -diketonate) coordination complex.
- 20 28. The method of claim 27, wherein the metal of said metal (β -diketonate) coordination complex comprises a transition metal.
29. The method of claim 27, wherein the metal of said metal (β -diketonate) coordination
25 complex comprises hafnium.

30. The method of claim 27, wherein the metal of said metal (β -diketonate) coordination complex comprises zirconium.
- 5 31. The method of claim 14, wherein the silicon-containing film is doped with a transition metal, and has a dielectric constant measured at 20°C of above about 10.
32. The method of claim 31, wherein the transition metal comprises hafnium.
- 10 33. The method of claim 31, wherein the transition metal comprises zirconium.
34. A method of forming a silicate film on a substrate by chemical vapor deposition, using a chemical vapor deposition precursor comprising an alkoxide β -diketonate silicon precursor in combination with at least one of (a) and (b):
- 15 (a) an alkoxide -diketonate precursor for one or more of Zr, Hf, Nb, and Ta; and
(b) a -diketonate precursor for one or more of Y, La, Sr and Ba.
35. The method of claim 34, wherein the alkoxide β -diketonate silicon precursor comprises
- 20 bis(t-butoxy)bis(tetramethylheptanedionato)silane.
36. The method of claim 34, wherein the silicate film constitutes at least part of a dielectric material of a Si-based CMOS capacitor.

37. The method of claim 34, wherein the chemical vapor deposition precursor comprises a solvent medium.

38. The method of claim 37, wherein the solvent medium comprises octane.

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